

# Interactive Visualization of the Building of University of Economics – Varna via 3D Modeling

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**Abstract.** The object of this paper is presenting the University of Economics – Varna, using a 3D model with 3Ds MAX. Created in 1920, May 14, University of Economics - Varna is a cultural institution with a place and style of its own. With the emergence of the three-dimensional modeling we entered a new stage of the evolution of computer graphics. The main target is to preserve the historical vision, to demonstrate forward-thinking and using of future-oriented approaches.

**Keywords:** 3D Modeling, 3D Model, Surface, 3D Rendering, 3D Print Devices

## 1 Introduction

In computer graphics, 3D modeling is a process of development of mathematical presentation of every three-dimensional surface (animate or inanimate object) via specialized software. The product realized is called a 3D model. It can be presented as a two-dimensional image via process, called 3D rendering, or it can be used in computer stimulation for some physical occurrences. The model can be also physically created by means of the 3D print devices.

The models can be created automatically or manually. The manual modeling is a process of preparing of geometrical data for 3D computer graphics and it is similar to plastic arts as sculpting is. In this type of modeling the designer creates himself every detail of the model and makes it unique. In automatic modeling some prepared blocks of the program are used (libraries), with the help of which a ready object prototype is created only by pushing one button.

The 3D models are widely used everywhere in 3D graphics. In fact their use precedes the wide use of 3D graphics for personal computers. Lot of computer games use pre-rendered images of 3D models as the sprites are (in computer graphics sprite is a two-dimensional image or animation, integrated in a bigger scene), before the computers could realize them in real time.

In our times 3D models are used in a wide specter of fields. The medical industry uses detailed images of organs. The film industry uses them as symbols and objects for cartoons and real life objects. The video games industry uses them as actives for computer and video games. The scientific sector uses them for high-detailed models of compounds. The architectural industry needs them to present buildings and land-

scapes via software for architectural models. The engineering community uses them for the design of new devices, vehicles and structures, as for many other purposes. In the last decades the three-dimensional graphics are increasingly wide applicable in business, in the field of production and services. 3D models and their simulation have different purposes but mainly for advertisement – of the business itself, of the realized products, of the presented services and so on. According to the present-day statistics more than 67% of these companies are developing now half of or more than a half of the design of their products in 3D.

The University of Economics – Varna as an educational structure, which offers services, is specialized in education and training of professionals in 17 different specialties with two possible forms of education (full-time and extramural). In 2013, the University celebrated 93 anniversary. Created in 1920, May 14, University of Economics - Varna is a cultural institution with a place and style of its own. As we approach the 100th anniversary of the university, it has established itself as a cultural center for the country, an architecture of the 20s of last century. The object of this abstract is presenting the University of Economics – Varna, using a 3D model.

For the realization of the objective a selection is made for defining the appropriate software to be used. The products of Adobe (Photoshop, After Effect) and Autodesk (3D Studio Max) are with priority as they are global leaders in this branch. There is wide variety of software for three-dimensional modeling and there are new products coming on the market annually. Depending of the field of application and of the wanted effects we can list leading programs in the branch as Rhino, Google SkechUp, DAZ Studio, Creator and so on. For the aim of our elaboration we will use the opportunities that 3D Studio MAX 2011 gives us. This program is equipped with a wide variety of tools and the possibility to install additional plug-ins.

## **2 Nature of the Three-dimensional Modeling**

The 3D models are actually objects, composed by assembly of points in the 3D space, connected with different geometrical elements as triangles, lines, curved surfaces and so on. By collecting that data (points and other information), 3D models can be created by hand, algorithmic (process modeling) or scanned.

The three-dimensional visualizations are a modern technology, which steps into the advertisement and the business in the last few years. The 3D images can be useful in architecture, design, product vision – actually everywhere, where there is need of visual presentation. They are actually photos, presenting the preliminary vision of an interior, a product or a building. Visualizations create the first full picture of the future product and that is why they can be very useful for the business, in our case from the 3D model of the building of University of economics – Varna future students get the first picture of the possibilities and the skills they can achieve within their training here. With the creation of this 3D model the University of Economics - Varna will preserve nearly 100 year old architecture in the future.

### **3 Creating and Constructing of Three-dimensional Models**

The process of creating of computer graphics starts with the nascence of the idea of constructing a three-dimensional model. First the designer chooses appropriate software with which he can realize his idea, after this the process of constructing if this model occurs in several contingent stages:

#### **3.1 Stage “Modeling”**

This is a process of creating of models, imaging some objects from the reality or the fantasy via 3D modeling program. All the models showed hereinafter are network /skeletal/ - i.e. composed by multiple connected between polygons.

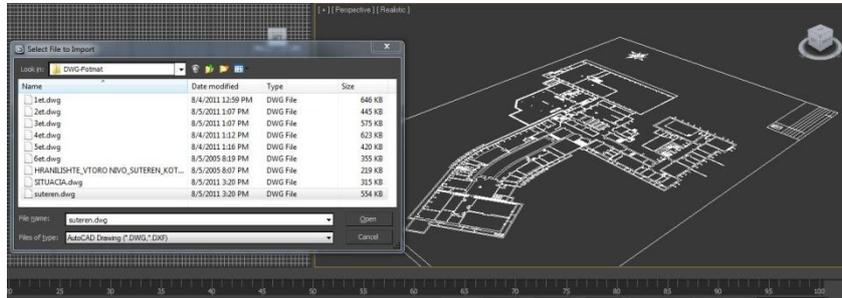
The methods of network modeling are not too much. All of them are based on the operations for amendment of polygons, their merge, split, transformation, shift, spin, move and the most important – their adjustment.

With the help of the modeling of skeletal objects any shape can be obtained practically – complex or simple. Network objects can be also created with the help of splines – flat or three-dimensional curves. For the creation of a network model the spline can be subjected to various effects.

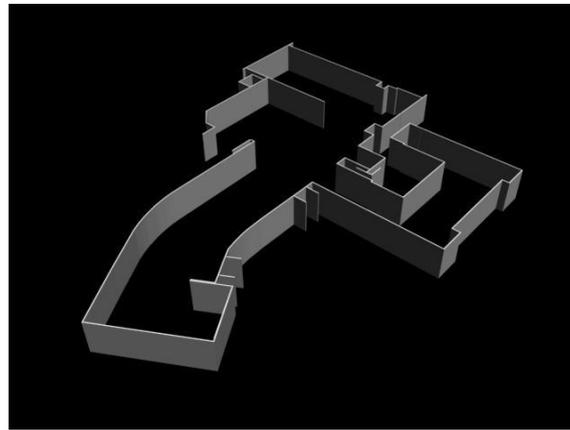
Within the process of modeling with particles the surface of the object is created by multiple small rectangles. The sides of these quadrilaterals are actually splines with 2 peaks.

Modeling is not the basic and determinative stage from the creation of three-dimensional graphics. Even the well done model can lose its qualities if it is dressed with poor texture, if it is poorly lit or photographed by improper angle. That`s why we must pass sequentially through all stages. Even before the first stage of the design of our model we need an architectural plan of the building. It will help us to build the walls and the facades in real size. 3D Studio MAX has the possibility to import different file formats. In this case we can use an AutoCAD file with plan of the building, saved in format .dwg, which is compatible with the two software products. On Figure (1) it is shown the principle of insertion of AutoCAD plan in 3D MAX via the function Import. The aim of the architectural plan is to give the model for construction of walls, windows, doors and in general to reach the genuine architectural reliability model.

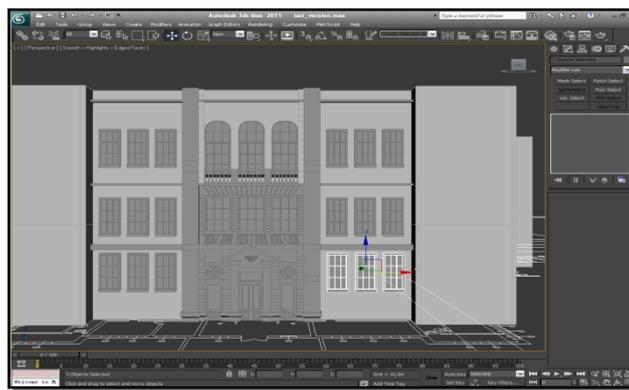
There are functions built in 3Ds MAX for creating of different architectural elements as there are functions for “extrude”, i.e. elevation, extraction from the two-dimensional scheme and respectively creation of a three-dimensional one. That`s why we start the building of our model as we adjust to the common scene a two-dimensional architectural plan of the building.



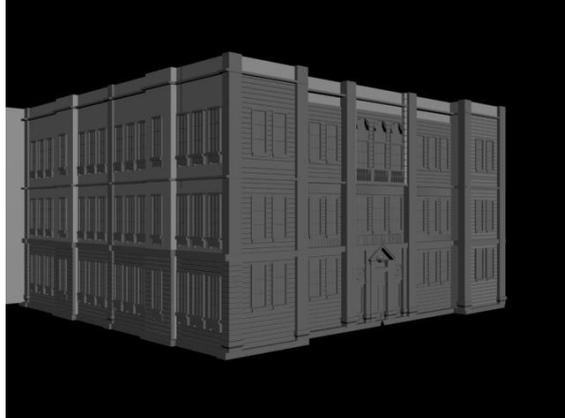
**Fig. 1.** Insertion of architectural plan



**Fig. 2.** Render of the built walls



**Fig. 3.** Final stage of the model's creating



**Fig. 4.** Final stage of the model's creating after using the function Array

### 3.2 Stage "Texturing"

These photographs (Figure 5) after suitable processing with Photoshop or other appropriate software (at the discretion of the developer) will be applied to polygons from the model as textures. Colors that we will use to create materials will be also drawn from them. Photographs help us to have an overview of the lighting and shadows, because our aim is to achieve as close to the real vision.



**Fig. 5.** Digital image of the facade of University of Economics – Varna

The color of every point of the object's surface is defined by the material. The material defines the coloration of the surface, its relief, transparency, shape and amount of glamour, effects of reflection, and refraction of light – all surface properties. 3Ds MAX covers many types of materials – from simple ones to multilayer and multi-component. The material in most of the cases contains sets of textural maps.

The textural maps are flatter image, describing different material properties. A raster image in some of the usual formats or a map, created on the base of mathematical

algorithms in 3ds max, could be used as this kind of map. The final texture map is called procedural. Examples for procedural map are the gradient textures or the eclipse textures.

To create photorealistic or just realistic scenes raster textures, photographed or scanned images are used. After scanning they have to be processed by using a program for 2D graphics. The most often used program for processing of photographs is Adobe Photoshop which is proven leader in this field.

Texturing is a method for adjusting of detail, surface texture or color to the computer generated graphics or to the three-dimensional model. With the help of the 3D MAX tools we can create a combination of color, light reflection or glossiness of material, imitation of relief surface or textile design and we can save it as a texture. After this we can apply the created texture on a certain polygon of our model and this way we can leave the impression that the model is real. This is done with the help of a special module called Material Editor (Figure 6).

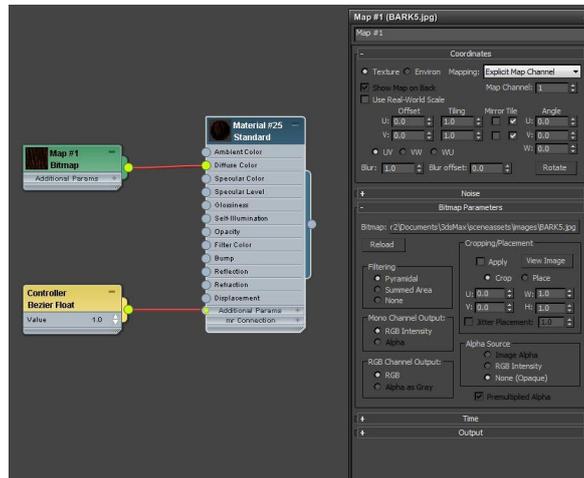


Fig. 6. Creating of new material

### 3.3 Stage “Lighting” – V-Ray 2.0

After the model is created and the needed texture for it is chosen so it looks realistic, it has to be lightened. When creating the lighting it is for the best to borrow as much as it is possible of real scenes or photographs. The sources of light in real conditions are never white. Their color hesitates from light blue to light red. This defines the general color mood of a certain scene. The three-dimensional scene shouldn't be too light or too dark. When we create the lighting every object that has some meaningful significance has to stand out compared to the others. If the complex algorithms for indirect lighting are not used, it happens sometimes to use 3 sources of light for the lighting of an object. The total of light sources in a scene can reach more than 10.

A complex scene can be lightened with 2-3 exactly located sources of light. This is achieved through the implementation of algorithms for indirect (diffuse) lighting.

When imitating an indirect lighting, the rays of light are refracted and reflected while the scene is moving, which effect gives physically accurate image. There is lighting also in these parts of the scene which are not directly visible from the source of light.

V-Ray is a render application, which is used as extension of the possibilities of 3dsMax. V-Ray uses modern techniques as: global illumination, path tracing, photon mapping, irradiance maps и global illumination. By using these techniques and the easier interface settings, V-Ray takes precedence over the standard renders, included in 3dsMax, as at the same time it offers excellent final results and short time of calculation and rendering.

### 3.4 Stage “Visualization”

This is a process of getting the two-dimensional image of the current scene or animation. Time for visualization is often significant. It depends of the scene`s geometry, the textural maps used, the number of light sources, the lighting algorithm. That is why visualizations are conditionally divided into preliminary and final.

In preliminary visualizations various simplifications are applied:

- A smaller size of the output image is set
- Simplified processing of the light sources
- The algorithm of indirect lighting is simplified
- The number of cut off and refracted rays is reduced
- In animation not every shot is visualized but every n-shot.

The fastest, easiest and less qualitative method of visualization is the preliminary preview (Preview). The final visualization of even small animated fragment could take couple of days when working with only one computer. That`s why there is a possibility provided in 3ds MAX for network visualizations as couple of computers are used for the calculations of a project.

V-ray is a core that uses advanced techniques as for example global algorithms for lighting path tracing, photon mapping, Irradiance maps for direct calculation of the global lighting. The use of these techniques makes it preferred over the conventional renders, provided as a standard with 3D software. On the whole using of this technique makes textures more realistic because the real lighting effects and weather conditions are imitated. After choosing the button Render the calculation of the image starts. Rending (building) of such image takes different periods of time depending of the model`s complexity and of the textures` difficulty. The period can be from few hours to couple of days. That`s why when making scale scenes for computer games or for the film industry there are couple of computers used for the calculation of such image. The effect of the applied V-ray settings we can see on Figure (7a), figure (7b) and Figure (7c).



**Fig. 7.** (a)(b)(c) Working view of the ready image

## 4 Conclusion

With the emergence of the three-dimensional modeling we entered a new stage of the evolution of computer graphics. Images grow from two- to three-dimensional, and in professional circles the term “fourth dimension” is already mentioned.

The presented abstract shows the process of creating of the 3D model of the building of University of Economics – Varna. The main target is reached, namely – to preserve the historical vision, to demonstrate forward-thinking and using of future-oriented approaches. By the produced high-quality images via the method Rendering the stage of visualization of the ready product is achieved. Even the three-dimensional building could be developed more with the creation of the internal spaces or with the modeling of options for upgrading the facade of the building.

## References

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